Discussion of Alternatives

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Alternatives

- **I**: No WAAS, no LAAS: expand ground-based navaid service. Vertical guidance provided by barometric (baro-) VNAV
- **II**: WAAS for lateral-only guidance. Baro-VNAV provides guidance at most airports
  - v0: ILS for precision approaches
  - v1: LAAS for precision approaches
- **III**: WAAS/LAAS for precision approaches, limited SATNAV availability compensated by ground-based navaids
- **IV**: WAAS/LAAS for precision approaches with increased availability, reduced ground-based navaids

Comparison of Alternatives

- Safety Perspective
  - Alt. I and II use baro-VNAV to provide 3-D approaches:
    - Baro-VNAV designed safety level is lower than precision approach
    - GA user acceptance is poor (higher user cost, lower user benefit)
  - Alt. III and IV yield similar safety improvement (Alt. IV would have higher equipage and more reliable precision approach)
    - Improved benefit in reduced runway incursions
- Economic Analysis
  - Alternative I is less expensive but does not deliver as much benefit
  - Alternatives IIv1, III and IV are similar cost
  - Best Benefit:Cost ratio expected for alternative IV

Comparison of Alternatives (2)

- International Issues
  - FAA leadership in navigation
    - US operators benefit from common, global RNAV capability
    - Other States have invested based on US commitment to SATNAV
  - US Government commitment to GPS
    - Alt. I and II could diminish international acceptance of GPS, promote proliferation of MLS

Comparison of Alternatives (3)

- NAS Architecture Compatibility
  - Alt. IV needed for full compatibility, Alt. III has acceptable compatibility (greater need to accommodate non-RNAV operations)
- User Acceptance
  - GA, regionals: Alt. I and II provide less benefit (decision height) at higher cost (altitude encoder, integration): no user support
  - Air carrier: Want RNAV benefits, want sole-service capability

Other Considerations

- Provide user benefit as early as possible
  - Maximize user benefit
  - Provide incentive to equip
- Spread FAA investment to promote affordability
- Define conservative ground-based navaid plan
  - extend life, expect to retain subset of ground aids

- General trend highlights Alternative IV
  - Difference between III and IV is not large

Risks of Alt. IV

- User equipage with SATNAV
  - User costs and benefits, demonstrate reliable service
  - Delay in LAAS implementation delays GNSS avionics equipage
  - Drives viability of decommissioning, which is significant FAA benefit
- GPS and WAAS performance under solar maximum
  - Precision approach availability may be impaired in some regions, not enough data
- Interference threat (unintentional and intentional)
- Long-term GPS sustainment policy could affect level of augmentation needed
  - Number of satellites, replenishment rate

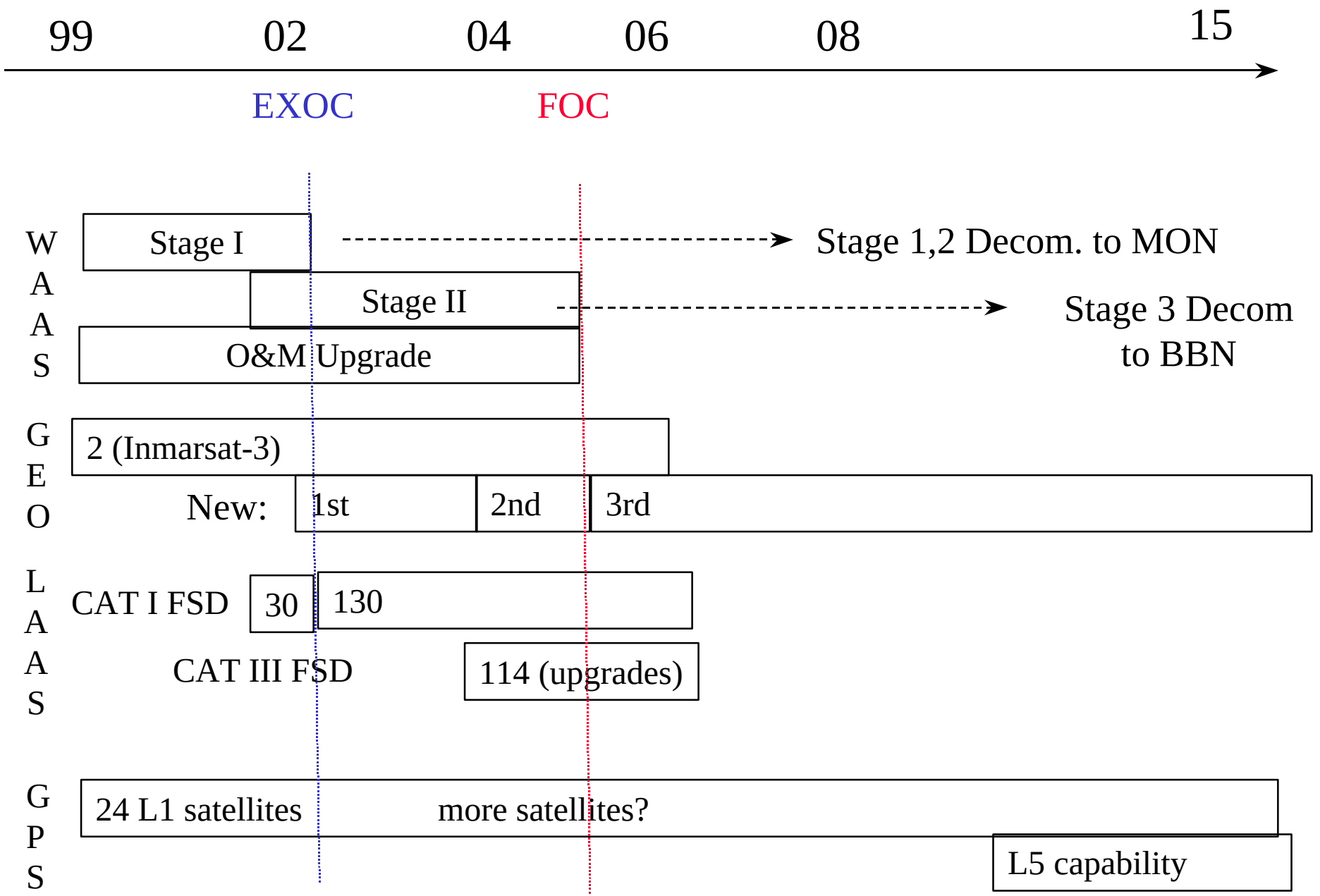
Obtaining Data to Reduce Risk

- User equipage
  - Experience with first-generation equipment can be extrapolated to future equipage if:
    - Initial benefit is worth user investment
    - Sufficient market exists to drive price down
    - FAA leads by demonstrating commitment
- Solar maximum
  - 2000/2001 will yield data
- Defined interference threat
  - Additional time to work with security community (intentional)
  - Widespread operational experience (unintentional)
  - Impact on ATC workload
  - Technical means of mitigation
- Long-term GPS sustainment policy
  - To be defined in GPS National Plan

Reduced Risk - Alternative IV

- Near-term investment: Expand precision approach coverage (EXOC)
  - WAAS reference stations and ionospheric algorithm
  - Accelerate LAAS CAT I to be commensurate with WAAS
- Mid-term investment
  - Further SATNAV improvements to availability
- WAAS GEO Satellite Plan: 3 GEOs (well-placed)
  - Near-term priority: eliminate single-point of failure (dual coverage everywhere)
  - Long-term priority: 3 sustainable GEOs
- Long-term: Gradual ground navaid decommissioning to a basic backup network (BBN) (~2015) (330 ILS, 220 VOR/DME)

Reduced Risk - Alternative IV



Future Checkpoints

- 2002: Review navigation architecture to identify candidate improvements
  - Baseline plan includes additional ref. stations, further algorithm improvement, third GEO, more LAAS: Provides FOC with existing GPS National plan
  - FOC may be available without further FAA investment depending on GPS National plan
  - If SATNAV has new limitations (e.g., user costs were higher than expected and user support has dwindled)
    - Reprioritize ground-based navigation aids
      - Plan for only decommissioning to Minimum Operational Network (520 ILS, 600 VOR/DME)
    - Keep SATNAV services at sole-means capability
- 06+: Refine decommissioning plan based on user acceptance and navaid status